

CLAIMS

We claim:

1. A method of transcoding video from a source format to a target format at a lower bitrate, the method comprising:
 - 5 obtaining type values for plural units of compressed video in the source format; decompressing the compressed video in the source format; and re-compressing the video to produce compressed video in the target format, including making first coding decisions based at least in part on the obtained type values to help match quality between the respective compressed video in the target and
 - 10 source formats, and further including independently making second coding decisions to make use of compression efficiencies of the target format to reduce bitrate.
2. The method of claim 1 wherein obtaining the type values comprises parsing the compressed video in the source format.
- 15 3. The method of claim 1 wherein independently making second coding decisions includes computing new motion vectors for motion compensation, and wherein use of motion vector information from the compressed video in the source format speeds up motion estimation for computing the new motion vectors.
- 20 4. The method of claim 3 wherein the motion estimation and compensation use loop filtering and intensity compensation.
5. The method of claim 3 wherein the motion estimation and compensation use
- 25 up to four motion vectors per macroblock and quarter-pixel motion vector precision.
6. The method of claim 1 wherein independently making second coding decisions includes selecting size of a variable-size frequency transform.
- 30 7. The method of claim 1 wherein independently making second coding decisions includes selecting prediction modes for motion vectors or prediction residuals.

- 36 -

8. The method of claim 1 wherein the decompressing comprises fully decompressing the compressed video.

9. The method of claim 1 wherein compression in the source format and
5 compression in the target format use different frequency transforms.

10. The method of claim 1 wherein compression in the source format and compression in the target format use different entropy encoding.

10 11. A computer-readable medium storing computer-executable instructions for causing a computer system programmed thereby to perform the method of claim 1.

12. The method of claim 1 wherein the plural units are video pictures, and wherein the type values are picture type values that include I picture, P picture, and B
15 picture.

13. The method of claim 1 wherein the bitrate of the compressed video in the target format is equal or below bitrate of the compressed video in the source format on a picture-by-picture basis for substantially all of the one or more video pictures.

20

14. The method of claim 1 wherein the plural units are macroblocks, and wherein the plural type values are macroblock coding type values.

15. The method of claim 14 wherein the macroblocks include an intra coded
25 macroblock and an inter coded macroblock, and wherein the macroblock coding type values include intra and inter.

16. The method of claim 1 wherein the source format is an MPEG-2 format, and wherein the target format is a WMV9 format.

30

17. A method of transcoding video from a first format to a second format at a lower bitrate, the method comprising:

obtaining picture type values for plural pictures of compressed video in the first format;

fully decompressing the compressed video in the first format; and

re-compressing the video to produce compressed video in the second format,

- 5 including making picture type decisions based at least in part on the obtained picture type values, and further including performing motion estimation and compensation to make use of compression efficiencies of the second format to reduce bitrate.

- 10 18. The method of claim 17 wherein the motion estimation and compensation in the second format differs from motion estimation and compensation in the first format in terms of use of loop filtering, number of motion vectors per macroblock, use of intensity compensation, and/or motion vector precision.

- 15 19. The method of claim 17 wherein the first format and the second format use different frequency transforms.

20. A computer-readable medium storing computer-executable instructions for causing a computer system programmed thereby to perform the method of claim 17.

- 20 21. The method of claim 17 wherein the picture type values include I picture, P picture, and B picture.

- 25 22. The method of claim 17 wherein the re-compressing includes using the picture type values to match one or more picture positions between the compressed video in the first format and the compressed video in the second format.

- 30 23. The method of claim 17 wherein the re-compressing includes using the picture type values to match group of picture structure between the compressed video in the first format and the compressed video in the second format.

24. A method of transcoding video comprising:

obtaining frame/field information for compressed video in a first format;

fully decompressing the compressed video in the first format; and
re-compressing the video to produce compressed video in a second format
different than the first format, including making coding decisions based at least in part
on the obtained frame/field information to help match the quality of the compressed
5 video in the second format to the quality of the compressed video in the first format.

25. The method of claim 24 wherein the re-compressing includes setting
field/frame types at macroblock level in the compressed video in the second format.

10 26. The method of claim 24 wherein the re-compressing includes setting
field/frame types at picture layer in the compressed video in the second format.

27. The method of claim 24 wherein the compressed video in the second format
has a bitrate lower than the bitrate of the compressed video in the first format.

15 28. The method of claim 24 wherein the re-compressing includes performing
motion estimation and compensation to make use of compression efficiencies of the
second format to reduce bitrate.

20 29. A computer-readable medium storing computer-executable instructions for
causing a computer system programmed thereby to perform the method of claim 24.

30. A method of transcoding video comprising:
obtaining quantization levels for compressed video in a first format;
25 decompressing the compressed video in the first format; and
re-compressing the video to produce compressed video in a second format,
including setting quantization levels for the compressed video in the second format
based at least in part on the obtained quantization levels, wherein compression in the
first format and compression in the second format use different frequency transforms.

30 31. The method of claim 30 wherein compression in the first format uses a DCT
and compression in the second format uses a fast integer transform.

32. A computer-readable medium storing computer-executable instructions for causing a computer system programmed thereby to perform the method of claim 30.

5 33. The method of claim 30 wherein the obtained quantization levels are for macroblocks of the compressed video in the first format.

34. The method of claim 30 wherein the re-compressing comprises setting a quantization level for a video picture of the compressed video in the second format
10 based at least in part upon an average of the obtained quantization levels.

35. The method of claim 30 wherein the re-compressing comprises setting a quantization level for a macroblock of the compressed video in the second format based at least in part upon one of the obtained quantization levels.
15

36. The method of claim 30 further comprising adjusting the obtained quantization levels for rate control before applying the quantization levels.

37. The method of claim 30 wherein considering the obtained quantization
20 levels helps match the quality of the compressed video in the second format to the quality of the compressed video in the first format.

38. A method of transcoding video comprising:
obtaining per-macroblock quantization levels for plural macroblocks of
25 compressed video in a first format;
decompressing the compressed video in the first format; and
re-compressing the video to produce compressed video in a second format,
including setting quantization levels for corresponding macroblocks of the compressed
video in the second format based at least in part on the obtained quantization levels.
30

39. A computer-readable medium storing computer-executable instructions for causing a computer system programmed thereby to perform the method of claim 38.

40. The method of claim 38 wherein the second format uses differential quantization level signaling at the macroblock layer.

5 41. The method of claim 38 wherein the quantization levels are quantization step sizes.

42. The method of claim 38 further comprising adjusting the obtained quantization levels for rate control before applying the quantization levels.

10

43. A method of transcoding video comprising:
obtaining quantization levels for compressed video in a first format;
decompressing the compressed video in the first format; and
re-compressing the video to produce compressed video in a second format,
15 including quantizing the compressed video in the second format to a degree comparable to the obtained quantization levels to reduce differences in quality between the respective compressed video in the first and second formats, wherein compression efficiencies of the second format substantially reduce bitrate of the compressed video in the second format compared to the compressed video in the first format.

20

44. The method of claim 43 including tracking quantization or bitrate at the picture level for the respective compressed video in the first and second formats.

25 45. The method of claim 43 including tracking quantization or bitrate at the macroblock level for the respective compressed video in the first and second formats.

46. The method of claim 43 wherein the compression efficiencies of the second format reduce bitrate of the compressed video in the second format by at least 20% compared to the compressed video in the first format.

30

47. The method of claim 43 wherein overall differences in quality between the compressed video in the second format and the compressed video in the first format are below visibility thresholds.

5 48. The method of claim 43 wherein motion estimation and compensation in the second format differ from motion estimation and compensation in the first format in terms of use of loop filtering, number of motion vectors per macroblock, use of intensity compensation, and/or motion vector precision.

10 49. The method of claim 43 wherein compression in the second format uses a variable-size frequency transform.

 50. The method of claim 43 wherein compression in the second format and compression in the first format use different prediction modes for motion vectors and/or
15 prediction residuals.

 51. The method of claim 43 wherein compression in the second format and compression in the first format use different entropy encoding.

20 52. A computer-readable medium storing computer-executable instructions for causing a computer system programmed thereby to perform the method of claim 43.

 53. A method of transcoding video comprising:
 decompressing compressed video in a first format; and
25 re-compressing the video to produce compressed video in a second format using a second format encoder with default one-pass variable bitrate encoding, including regulating compression parameters of the second format encoder to produce the compressed video in the second format at a constant or relatively constant bitrate by varying quality and bitrate in proportion to one or more rate control criteria.

30

 54. The method of claim 53 wherein the one or more rate control criteria are based at least in part on buffer fullness values.

55. The method of claim 53 wherein the one or more rate control criteria are based at least in part on deviations between allocated bits and used bits for previous video.

5

56. A computer-readable medium storing computer-executable instructions for causing a computer system programmed thereby to perform the method of claim 53.